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THE TAXONOMY OF UTAH ORTHOPTERA¹

ANDREW H. BARNUM²
Grand Junction, Colorado

INTRODUCTION

During the years of 1950 to 1952 a study of the taxonomy and distribution of the Utah Orthoptera was made at the Brigham Young University by the author under the direction of Dr. Vasco M. Tanner. This resulted in a listing of the species found in the State. Taxonomic keys were made and compiled covering these species. Distributional notes where available were made with the brief descriptions of the species.

The work was based on the material in the entomological collection of the Brigham Young University, with additional records obtained from the collection of the Utah State Agricultural College. In addition, those Orthoptera reported from the State in previous literature were included. Those species which have apparently been erroneously reported were commented upon, but not counted in the figures.

As a result of this study, 202 species (or subspecies) in 90 genera of Orthoptera have been reported from the State. In addition to this number, seven species in five genera are reported as hypothetical (marked^H in listings in this paper). These species have been collected in Arizona near the Utah border and should be eventually found in Utah owing to the absence of ecological barriers. Of the 4200 Utah specimens in the Brigham Young University collection, 152 species are represented. Many of these specimens have been classified by the leading authorities on Orthoptera. An additional 23 species were examined at the Utah State Agricultural College.

1. In this study the roaches, praying mantids, walking-sticks, grasshoppers or locusts and crickets are all considered as being in the Order Orthoptera. The earwigs (Order Dermaptera) are not included, though some authors consider them as being part of the orthopteran group.
2. Abstracted from a Master's thesis submitted to the Department of Zoology and Entomology, Brigham Young University, June, 1952. Contribution No. 146 from the Department of Zoology and Entomology.

Thirty-four species were not available for examination. Thirty-eight species and seventeen genera were established as new records for the state and are marked with an asterisk (*) in this paper. (These species had not been reported from the State when the Thesis was prepared, but later publications may have included some of them.) One species has been collected by the author since this research was completed, and is included in the present listings. Fifteen species have been erroneously reported as having been collected in the State by earlier workers and were not included in the totals. Nine unpublished records were found in the U.S.A.C. collection (marked^{AC} in this paper).

The following table is a breakdown of the genera and species (or subspecies) reported from each family group:

	Total Reported Genera Species	New Records Genera Species	Hypothetical Genera Species	Records in USAC Collection	Erroneous Reports
Blattidae	7 7	4 4			
Mantidae	2 3				
Phasmidae	3 4				
Tetrigidae	4 8				
Acrididae	54 140	5 23	4 4	7 10	
Tettigoniidae	19 35	7 7	1 3	2 5	
Gryllidae	6 12	1 4			
Total	95 209	17 38	5 7	9 15	

USE OF THE KEYS

The keys presented in this study are only partially descriptive and are merely for convenience. They are intended as a short cut in identification. Confusing morphological characteristics were represented by drawings in order to make the keys more readily adaptable for use.

These keys cover the species definitely known from Utah, and include several species found in adjoining states. As other species are found a revision of the keys will be necessary.

In cases involving any doubt of identification, a full description of the species in question should be checked, or comparisons made with accurately determined specimens. In the matter of descriptions the worker may run into difficulty. Anyone studying early descriptions realizes that most descriptions of species are completely inadequate if not entirely useless. They perhaps separated the known species at the time, but the constant addition of new species to the literature has limited the use of the original descriptions. It may therefore be necessary to check a complete description given by a recent author.

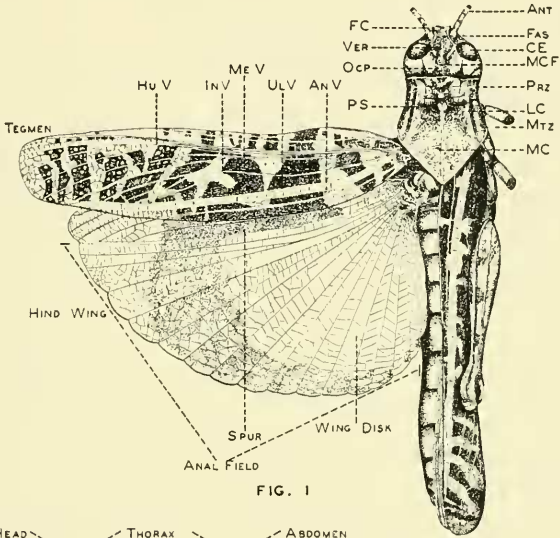


FIG. 1

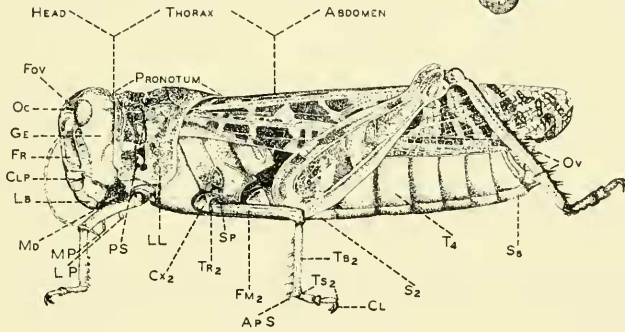


FIG. 2

The keys presented herein are incomplete in that they classify the insects only to Genus. For keys to species and subspecies the reader is referred to the original Thesis or to one of the many publications covering that particular group.

KEYS TO THE FAMILIES OF ORTHOPTERA

1. Posterior legs enlarged and strongly modified for jumping; stridulating insects. (2)
Posterior legs not enlarged for jumping, all legs equal in size; stridulating organs not developed (5)
2. Antennae long and filiform; tarsi three- or four-segmented; ovipositor usually elongate, with its parts compact (3)
Antennae usually much shorter than body; tarsi three-segmented; ovipositor short, composed of four separate parts (4)
3. Tarsi four-segmented; wings, when present, sloping at sides of body; ovipositor, when exerted, a long, compact blade. (Long-horned grasshoppers, katydids, etc.) Family *Tettigoniidae*
Tarsi three-segmented or reduced; wings, when present, horizontal in greater part. (Crickets) Family *Gryllidae*
4. Pronotum narrowed behind and prolonged backward to or beyond the tip of the abdomen; size very small. (Grouse or Pygmy Locusts) Family *Tetrigidae*
Pronotum never extending over the abdomen. (Locusts or Short-horned grasshoppers) Family *Acrididae*
5. Anterior legs spined, highly specialized for grasping prey. (Praying mantids) Family *Mantidae*
Anterior legs not specialized for grasping (6)
6. Body elongate and slender; legs slender, rounded; head free. (Walkingsticks) Family *Phasmidae*
Body flat, broad, oval; legs compressed; head withdrawn beneath pronotum. (Cockroaches) Family *Blattidae*

FAMILY BLATTIDAE (Cockroaches)

Insects with strongly depressed, more or less oval, bodies are readily referred to the family Blattidae. Other distinguishing characteristics separate them from other families of Orthoptera. The head is concealed beneath the pronotum, the face ventral, the mouth posterior. The antennae are long and filiform. The legs are slender, similar, and compressed. When fully developed, the tegmina are parchment-like and overlapping, and the wings membranous. Both tegmina and wings are often rudimentary or wanting in the female and sometimes in both sexes.

The sexes may be distinguished without difficulty, although there is no visible ovipositor. The males are characterized, in addition to the conspicuous cerci, by the presence of a pair of styles (Pl. II, Fig. 1), at the sides of the hind margin of the last ventral segment of the abdomen.

1. Middle or hind femora, or both, unarmed posteriorly, or armed with hairs or bristles only, or with one or two apical or subapical spines (Pl. II, Fig. 5) (2)
Middle and hind femora armed posteriorly with two or more distinct spines (Pl. II, Fig. 8) (3)

2. Surface of pronotum and tegmina glabrous; claws separated by a distinct arolium (Pl. II, Fig. 9). Adventive
 *Panchlora cubensis* Saussure*
 Surface of pronotum and tegmina hairy; no arolium between the claws, or only a minute one *Arenivaga erratica* Rehn
3. Pronotum and tegmina densely pubescent. Adventive.
 *Nyctobora noctivaga* Rehn*
4. Pronotum and tegmina smooth, or but sparsely haired or pilose .. (4)
 Pronotum 7 mm. or more in length (5)
 Pronotum less than 7 mm. in length (6)
5. Tegmina in both sexes extending considerably beyond the tip of the abdomen *Periplaneta americana* (Linnaeus)*
 Tegmina in both sexes not reaching the tip of the abdomen.
 *Blatta orientalis* Linnaeus
6. Tegmina of male extending beyond tip of abdomen; subgenital plate of female entire (Pl. II, Fig. 4) (7)
 Tegmina of male shorter than abdomen; subgenital plate of female divided or split (Pl. II, Fig. 3) *Blatta orientalis* Linnaeus
7. Margin of fore femora armed posteriorly on basal half with from 3 to 6 strong spines succeeded distally by a row of smaller close-set spinules (Pl. II, Fig. 7); pronotum with two stripes of darker brown; styles of male indistinct or wanting *Blattella germanica* (Linnaeus)
 Margin of fore femora armed posteriorly along its entire length with stout spines which diminish in length toward the apex (Pl. II, Fig. 6); pronotum without two dark brown stripes; styles of male distinct
 *Supella supellectilium* (Serville)*

FAMILY MANTIDAE (Mantids, Praying Insects, Soothsayers)

Members of the family Mantidae are strikingly peculiar in appearance. These insects have the femora and tibiae of the front legs enlarged and heavily spined for seizing insect prey. The middle and hind legs are slender. The body is elongate, with a free and transverse head. The wings in the female are often shorter than the abdomen. There is no visible ovipositor. Both sexes (Pl. II, Figs. 10 & 11) have a pair of short jointed cerci attached to the sides of the supra-anal plate, while the males have in addition a pair of much shorter styles near the apex of the subgenital plate. Sound producing organs are absent.

Only two genera have been found in Utah, being readily separated by size and morphological characteristics. In the genus *Litaneutria*, of which there is only one species in the State (*L. minor* scudder), the pronotum is only slightly longer than the anterior coxae; the posterior femora is armed with an apical spine. Members of the genus are less than 32 mm. in length. The genus *Stagmomantis* contains two species. The adults are more than 50 mm. in length, the pronotum is much longer than the anterior coxae, and there is no apical spine on the posterior femora. Both *S. carolina* (Johannson) and *S. californicus* Rehn & Hebard have been found in the State.

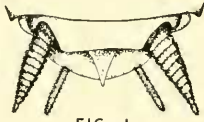


FIG. 1



FIG. 2

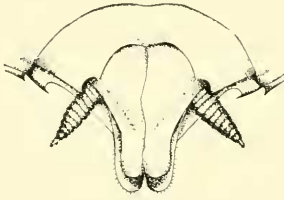


FIG. 3



FIG. 4

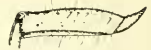


FIG. 5

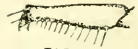


FIG. 6



FIG. 8



FIG. 9

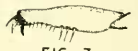


FIG. 7

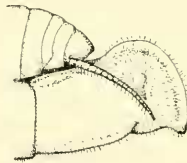


FIG. 10



FIG. 11

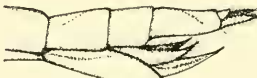


FIG. 12



FIG. 14

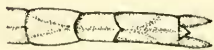


FIG. 13

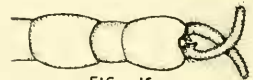


FIG. 15

FAMILY PHASMIDAE (Walking-Sticks)

The walking-sticks are among the curiosities of the insect world. They are remarkable for their resemblance to twigs of plants or to dead grass, and are protected effectively by their habit of moving very slowly and of remaining motionless for long periods of time. They have an elongate, slender, and cylindrical body with an exerted head. The prothorax is very short, the mesothorax and metathorax elongate. The legs are slender and alike in form. Tegmina and wings are lacking in all the United States species. A large arolium is present between the claws at the end of the five-segmented tarsus. The ovipositor of the female is concealed by the subgenital plate and the cerci are not joined (Pl. II, Figs. 12-15).

1. Antennae distinctly longer than anterior femora (2)
 Antennae not more than one-half as long as anterior femora.
 Genus *Parabacillus*
 P. hesperus Hebard
 P. coloradus (Scudder)
2. Head carinate; middle femora of male slender, not thicker
 than posterior ones; posterior femora unarmed in both
 sexes *Pseudosermyle stramineus* (Scudder)
 Head smooth; middle femora of male much swollen, distinct-
 ly thicker than posterior ones; posterior femora armed be-
 neath near apex with a single spine, in male very promi-
 nent, in female often very small and sometimes wholly
 absent *Diapheromera femorata* (Say)

FAMILY TETRIGIDAE (Pygmy or Grouse Locusts)

The pygmy or grouse locusts are among the smallest representatives of the Order Orthoptera and may be readily recognized by the prolonged pronotum which covers most of the body. This specialization provides protection for the delicate wings and replaces the tegmina, which have been reduced to small oval lobes or scales. The wings are usually present and well developed, but in some species are not infrequently reduced in size and rarely are obsolete or unfit for normal functions. The length of the pronotum also varies with the size of the wings. Both long and short winged individuals occur in the species. The prosternum projects forward as a chin piece covering the mouthparts. The pulvilli between the tarsal claws are absent. The subgenital plate of the male is conical or triangular; the cerci very small. The female may be recognized by the serrulate ovipositor with sharp diverging extremities.

1. Vertex extending forward beyond front of eyes, distinctly
 wider than one of them when viewed from above, its front
 margin angulate or rounded (Pl. III, Figs. 3 & 4) (2)
 Vertex not at all or barely advanced beyond eyes and usually
 narrower than one of them, its front margin truncate;
 front margin of pronotum reaching eyes (Pl. III, Fig. 5) (3)
2. Median carina of pronotum raised in the form of a crest

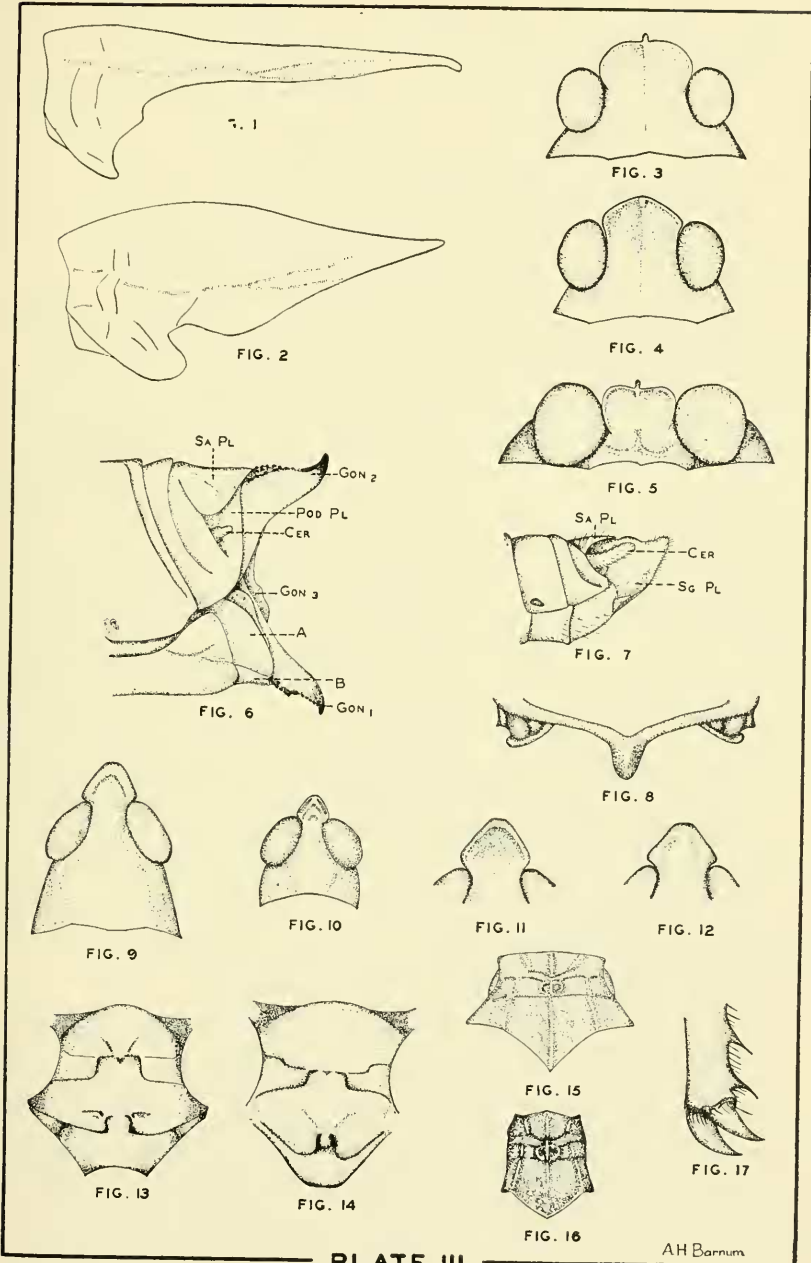
- and more or less arched lengthwise, its dorsal front margin produced in an angle over the back of the head; posterior process of pronotum usually much abbreviated (Pl. III, Fig. 2) *Nomotettix cristatus* (Scudder)
- Median carina of pronotum low, not arched, its front margin truncate or very obtuse-angulate (Pl. III, Fig. 1) .. Genus *Acrydium*
A. subulatum (Linnaeus)
A. incurvatum (Hancock)
A. acadicum acadicum (Scudder)
A. acadicum brunneri (Bolivar)
3. Antennae 13-segmented; frontal costa not at all sinuate; dorsal surface of pronotum distinctly rugose *Apotettix rugosus* (Scudder)
- Antennae 14-segmented; frontal costa, in profile, feebly but distinctly sinuate in front of the eyes; pronotum granulose, rarely finely scabrous Genus *Paratettix*
P. cucullatus (Burmeister)
P. mexicanus mexicanus (Saussure)

FAMILY ACRIDIDAE (Locusts or short-horned Grasshoppers)

Those exceedingly numerous and common grasshoppers from early spring to late autumn belong to the family Acrididae. They are characterized by relatively short antennae, usually shorter than the body. The tarsi are usually three-segmented; the front and middle legs subequal in size, much smaller and shorter than the hind legs which are highly modified for jumping. The tegmina are usually dull colored and thickened; the hind wings membranous, fan-shaped, and may be brightly colored. The ovipositor of the female consists of four short valves projecting from the tip of the abdomen, two of which curve upward and two downward (Pl. III, Fig. 6). The abdomen of the male terminates in the compact subgenital and supra-anal plates which conceal the male reproductive organs (Pl. III, Fig. 7).

The four subfamilies of the Acrididae are individually keyed because of the numerous genera and species represented in the family.

1. Prosternum armed with a distinct conical or cylindrical tubercle or spine (Pl. III, Fig. 8). Tarsal pulvilli exceptionally large Subfamily *Cyrtacanthacrinae*
 Prosternum without tubercle (2)
2. Antennae shorter than front femora. Wings completely absent. Hypothenetical in extreme southwestern Utah. Subfamily *Morseinae*. One species, *Morsea californica dumicolo* Rehn & Hebard^H
 Antennae longer than front femora (3)
3. Outer margin of hind tibiae armed with an apical spine next to the two apical spurs (apparently with three apical external spurs) (Pl. III, Fig. 17) Subfamily *Romaleinae*
 Outer margin of hind tibiae armed with no apical spine (with only two apical spurs) (4)
4. Median carina of pronotum thread-like, lateral carinae distinct; face usually slanting and forming an angle with the vertex; hind wings never banded or brightly colored;



tarsal pulvilli large Subfamily *Acridinae*
 Median carina of pronotum usually raised crest-like above
 the pronotum, lateral carinae poorly developed; face nearly
 vertical and rounded at meeting with vertex; wings
 long, hind wings usually brightly colored and with a black
 band Subfamily *Oedipodinae*

KEY TO ACRIDINAE

1. Lateral foveolae of vertex forming a right or acute angle
with plane of fastigium and invisible from above (Pl. III,
Fig. 9); face usually strongly slanting, forming an angle
with vertex (2)
Lateral foveolae of vertex forming an obtuse angle with
plane of fastigium and visible from above (Pl. III, Fig.
10); face usually vertical and rounded at meeting with
vertex (13)
2. Antennae strongly ensiform; lateral carinae of pronotum
parallel or weakly divergent caudad (3)
Antennae simple, slightly flattened, or clavate; lateral
carinae of pronotum curved (5)
3. Dorsal length of head greater than that of pronotum; form
very slender, linear; vertex greatly produced
..... *Paropomala wyomingensis* (Thomas)*
Dorsal length of head less than that of pronotum; form less
slender; vertex less strongly produced (4)
4. Male subgenital plate nearly twice as long as the preceding
sternite; size smaller, male 23-27 mm., female 27-30 mm.
..... *Pseudopomala brachyptera* (Scudder)
Male subgenital plate shorter than the preceding sternite;
size larger, male 26-32 mm., female 26-45 mm.
..... *Mermiria maculipennis macchungi* Rehn
5. Pronotum saddle-shaped; head distinctly elevated above
pronotum (6)
Pronotum normal; head not distinctly elevated above pronotum .. (7)
6. Fastigium strongly ascendant, not carinate; antennae very
elongate, flattened. *Pedioscirtetes nevadensis* Thomas*
Fastigium not strongly ascendant, with a feeble medio-longi-
tudinal carina; antennae short and simple
..... *Boottetix punctatus* (Scudder)
7. Fastigium with surface largely convex, lacking a conspicuous
infra-marginal impression (Pl. III, Fig. 12). (8)
Fastigium of vertex with surface concave or with a con-
spicuous infra-marginal impression (Pl. III, Fig. 11) (11)
8. Supplementary carinae absent on head and pronotum; teg-
mina and wings usually reduced; lateral carinae of pro-
notum straight, parallel, prominent and elevated
..... *Opeia obscura* (Thomas)
9. Internal spurs of caudal tibiae equal (10)
Internal spurs of caudal tibiae decidedly unequal
..... *Eritettix variabilis* Bruner*
10. Caudal tibiae supplied with more numerous (16 to 18 in
female) external spines *Syrbula fuscovittata* Thomas
Caudal tibiae supplied with fewer (12 to 15) external spines.
..... Genus *Amphitornus*
..... *A. coloradus ornatus* McNeill
..... *A. coloradus saltator* Hebard
11. Fastigium of vertex with a medio-longitudinal carina
..... *Neopodismopsis abdominalis* (Thomas)H

- Fastigium of vertex without a medio-longitudinal carina(12)
12. Antennae subsensiform; lateral carinae of pronotum well indicated in color, but obsolete or subobsolete in contour
 Genus *Cordillacris*
C. occipitalis occipitalis (Thomas)
C. occipitalis cinerea (Bruner)
C. crenulata crenulata (Bruner)
- Antennae simple; lateral carinae of pronotum weakly to strongly developed. Genus *Orphulella*
O. compta Scudder
O. pelidna desereta Scudder
13. Pronotum saddle-shaped, lateral carinae absent; costal field of tegmina expanded
 *Ligurotettix coquilletti coquilletti* McNeill^H
- Pronotum normal, lateral carinae present; costal field of tegmina normal (14)
14. Antennae clavate in both sexes
 *Aeropedellus clavatus clavatus* (Thomas)
- Antennae simple (15)
15. Face slanting, meeting the vertex at an angle; wings short (16)
- Face nearly vertical and rounded at vertex; wings long or short (17)
16. Form moderately slender; face and eyes oblique; internal spurs of caudal tibiae equal *Chorthippus longicornis* (Latreille)
- Form moderately robust; face rounded and moderately oblique, eyes almost vertical; internal spurs of caudal tibiae moderately unequal Genus *Bruneria*
B. alticola (Rehn)
B. brunnea (Thomas)*
17. Median carina of pronotum distinct (18)
- Median carina of pronotum obsolete for most of its length.
 *Heliaula rufa* (Scudder)
18. Hind tibiae blue; median carina of pronotum low on posterior part of prozone and cut by two sulci (19)
- Hind tibiae red or tan; median carina continuous and cut by one sulcus (20)
19. Wings shorter than abdomen; with distinct dark markings on body *Drepanopterna femoratum* (Scudder)
- Wings longer than abdomen; dark markings indistinct.
 *Aulocara elliotti* (Thomas)
20. Hind tibiae buff or pink in color; lateral carina of pronotum continuous and sharply constricted in middle; prozone shorter than metazone Genus *Psoloessa*
P. delicatula delicatula (Scudder)
P. texana texana Scudder*
- Hind tibiae red; lateral carina obsolete on prozone; prozone longer than metazone Genus *Ageneotettix*
A. deorum deorum (Scudder)
A. deorum curtippennis Bruner^{AC}

KEY TO OEDIPODINAE

1. Interspace of metasternum linear, or distinctly longer than broad in male; narrower than interspace between the mesosternal lobes in female (Pl. III, Figs. 13 and 14) (2)
- Interspace of metasternum rather broad, quadrate in male, transverse in female (4)
2. Intercalary vein nearer median than ulnar vein; wings brightly colored, red or yellow Genus *Arphia*
A. pseudonietana pseudonietana (Thomas)
A. conspersa Scudder
- Intercalary vein midway between or nearer the ulnar than the median vein; wings not brightly colored (3)

3. Intercalary vein nearer the ulnar than the median vein
Encoptolophus pallidus subgracilis Caudell*
 Intercalary vein midway between the median and ulnar
 veins *Chortophaga viridifasciata* (DeGeer)
4. Lateral carinae of pronotum not transversely intersected by
 principal sulcus which is obsolete or indistinct on lateral lobes (5)
 Lateral carinae of pronotum transversely intersected by
 principal sulcus which is distinct on lateral lobes (9)
5. Median carina of pronotum conspicuous and well elevated;
 distal half of tegmina membranous and with quadrate cells (6)
 Median carina of pronotum slight; only distal one-fourth of
 tegmina membranous Genus *Leprus*
L. wheeleri (Thomas)
L. interior Bruner
6. Wings clear and without fuscous band; pronotum not
 rugose *Cannula pellucida* (Scudder)
 Wings decidedly colored, red or yellow, and with fuscous
 transverse band; pronotum rugose (7)
7. Median carina of pronotum not depressed between two
 transverse incisions (8)
 Median carina of pronotum depressed between two trans-
 verse incisions; or mid-portion of carina depressed if the
 two incisions are not clear (Pl. I, Fig. 2) Genus *Xanthippus*
X. corallipes corallipes (Haldeman)
X. corallipes leprosus Saussure*
X. corallipes altivolus Scudder*
X. griseus Scudder
X. calthulus Saussure
8. Lateral lobes of pronotum slightly wider below than in
 middle *Cratypedes neglectus* (Thomas)
 Lateral lobes of pronotum equal, not wider below than in
 middle (Pl. I, Fig. 2) Genus *Xanthippus*
9. Median carina of pronotum high, cristate, arched on prozone
 and metazone and with only one deep transverse incision (10)
 Median carina of pronotum not high and cristate and with
 two deep transverse incisions (11)
10. Wings without median transverse fuscous band. Genus *Dissosteira*
D. carolina (Linnaeus)
D. spurcata Saussure
 Wings with median transverse fuscous band Genus *Spharagemon*
S. equale (Say)
S. collare (Scudder)
11. Posterior margin of pronotum broadly rounded or slightly
 angulate (Pl. III, Fig. 16) (13)
 Posterior margin of pronotum decidedly angulate (Pl. III,
 Fig. 15); median carina of pronotum high, with two deep
 transverse incisions; lateral prominences present near
 median carina of pronotum. (12)
12. Size larger than 28 mm.; inner face of hind femora marked
 with blue *Metator pardalinus* (Saussure)
 Size smaller than 26 mm.; no blue present on hind femora.
 *Trachyrhachis kiova kiova* (Thomas)
13. Median carina of pronotum cut by two sulci, the anterior one
 of which is shallow; lateral carinae long and cut by pos-
 terior sulcus; size large (14)
 Median carina cut by two nearly equal sulci; lateral carinae
 of pronotum indistinct or not cut by posterior sulcus; size
 small, form slender (16)
14. Median carina of pronotum distinct (15)
 Median carina of pronotum slight Genus *Leprus*
15. Margins of lateral lobes of pronotum nearly parallel (Pl. I,

- Fig. 2) Genus *Xanthippus*
 Hind margin of lateral lobe of pronotum slightly produced
 below *Cratypedes neglectus* (Thomas)
16. Posterior angle of lateral lobe of pronotum rounded; with
 or without a tooth (17)
 Posterior angle of lateral lobe acutely produced (25)
17. Posterior angle of lateral lobe of pronotum with a tooth (18)
 Posterior angle of lateral lobe without a tooth (20)
18. Disk of hind wing red; lateral elevations present adjacent
 to median carina of pronotum *Trepidulus rosaceus* (Scudder)
 Disk of hind wing not red; lateral elevations of pronotum
 not present (19)
19. Median carina of metazone elevated Genus *Conozoa*
C. wallula (Scudder)
C. sulcifrons (Scudder)
C. constricta Henderson
- Median carina of metazone very low Genus *Trimerotropis*
T. cristata McNeill
T. gracilis gracilis (Thomas)
T. bilobata Rehn & Hebert*
T. caeruleipennis Bruner
T. cyaneipennis Bruner
T. sparsa (Thomas)
T. strenua McNeill
T. citrina Scudder
T. tolteca modesta Bruner*
T. latifasciata Scudder
T. laticincta Saussure
T. agrestis McNeill
T. juliana Scudder
T. inconspicua Bruner*
T. pallidipennis pallidipennis (Burmeister)
T. titusi Caudell*
T. cincta (Thomas)*
T. suffusus (Scudder)
T. arizonensis Tinkham
T. viriditibialis Henderson
20. Metazone smooth or with scattered granulations (21)
 Metazone rugose-tuberculate; lateral prominences present
 near median carina of pronotum Genus *Derotmema*
D. delicatulum Scudder*
D. haydenii rileyianum Saussure
21. Median carina of pronotum cut nearly in the middle by
 posterior sulcus; sides of pronotum marked with black.
 *Mestobregma impexum* Rehn
- Median carina of pronotum cut considerably before middle
 by poster sulcus (22)
22. Form robust; antennae long; inner face of hind femora blu-
 ish-black. *Hadrotettix trifasciatus* (Say)
 Form slender; antennae of normal length; inner face of
 hind femora not bluish (23)
23. Radiate veins of anal field of wing not swollen
 Genus *Trimerotropis*
- Radiate veins of anal field of wing distinctly swollen (24)
24. Swollen veins prominent only in anterior half or two-thirds
 of anal field; wing disk yellowish Genus *Circotettix*
C. rabula rabula Rehn & Hebard
C. rabula altior Rehn
C. rabula nigrifasciatus Beamer
C. verruculata (Kirby)
- Swollen veins prominent in entire anal field; wing disk col-

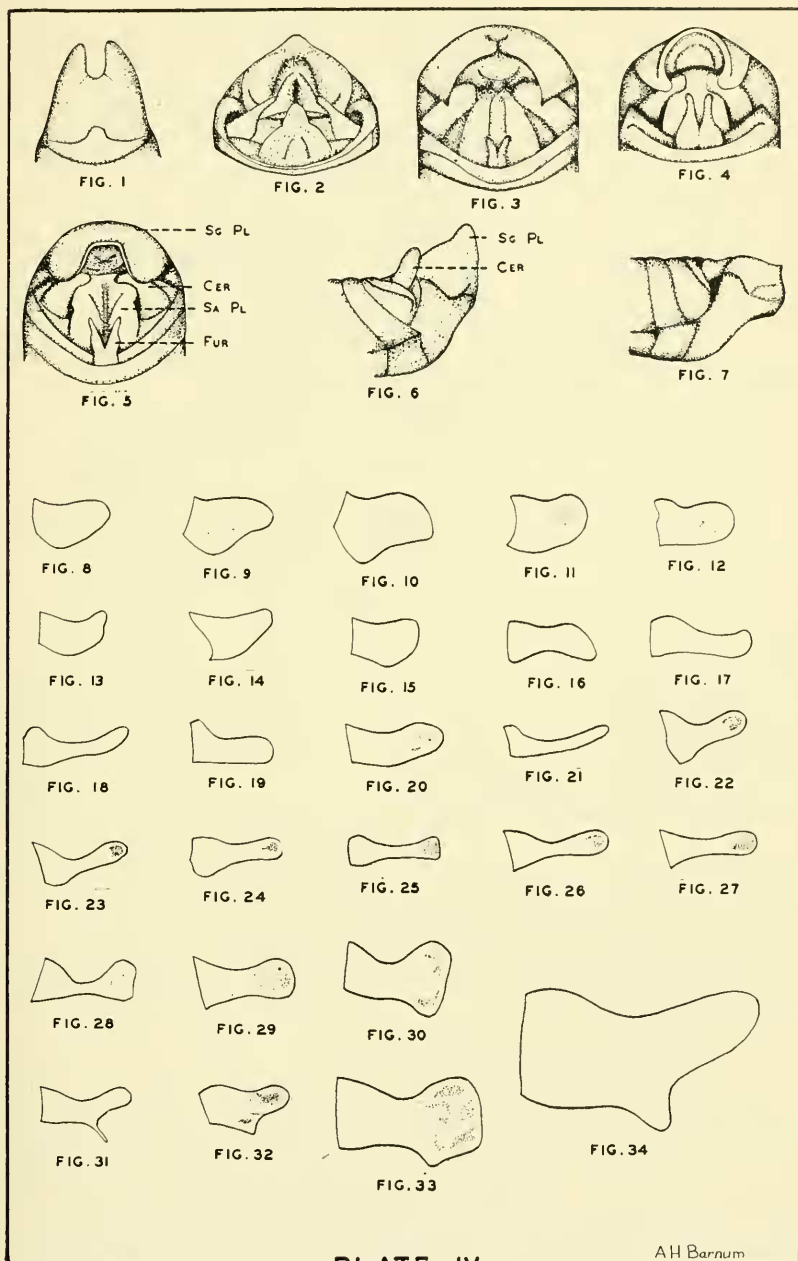
- orless or blackish *Aerochoreutes carlinianus strepitus* Rhen
 25. Posterior margin of pronotum rounded *Anconia integra* Scudder
 Posterior margin of pronotum angulate; disk of hind wings
 pale yellow *Cibolacris parviceps aridus* (Bruner)

KEY TO ROMALEINAE

1. Wings or wing pads present; size large, 27 mm. (2)
 Wings absent; size small, 16 mm.; antennae very long
 *Tanaocerus koebeli koebeli* Bruner
 2. Wings long, fully developed; pronotum smooth, carinae
 simple *Tytthotyle maculata* Bruner^H
 Wings reduced to pads; pronotum flat, broad, elongated,
 covered with tubercles *Phrynotettix tschivavensis* (Haldeman)

KEY TO CYRTACANTHACRINAE

1. Male subgenital plate with deep apical cleft (Pl. IV, Fig. 1);
 tegmina and wings very long Genus *Schistocerca*
S. shoshone (Thomas)
S. alutacea (Harris)
 Male subgenital plate not cleft (2)
 2. Wings completely absent; form small, very broad
 Genus *Bradynotes*
B. kaibab Hebard
B. obesa (Thomas)
 Wings present; form normal (3)
 3. Tegmina and wings well developed, attaining or exceeding
 abdominal tip (4)
 Tegmina and wings reduced to small non-functional pads (7)
 4. Body color bright green with white dorsal stripe on pro-
 notum and white lateral patches on thorax; tegmina
 bluish-green, with very narrow white stripes,
 Genus *Hesperotettix*
H. viridis viridis (Thomas)
H. viridis pratensis Scudder
H. viridis nevadensis Morse
H. viridis termius Hebard
H. curtipennis Scudder
 Body color not as above (5)
 5. Tegmina pale greenish; pronotum and caudal femora bluish-
 green marked with red and yellow
 *Poecilotettix sanguineus* Scudder*
 Tegmina and body darker in color; pronotum and caudal
 femora not marked with red and yellow (6)
 6. Subgenital plate of male with a subapical cone (Pl. IV,
 Fig. 2); cerci of male always slender, never broad and flat-
 tened. Genus *Aeoloplus*
A. tenuipennis Scudder
A. chenopodii (Bruner)
A. turnbulli turnbulli (Thomas)
 Subgenital plate without an apical cone or point (if a
 minute tubercle is present, the cerci are broad and flat-
 tened). Genus *Melanoplus*
M. marshalli marshalli (Thomas)
M. marshalli ascensor (Scudder)
M. occidentalis occidentalis (Thomas)
M. occidentalis brevipennis Bruner*
M. cuneatus Scudder*
M. rugglesi Gurney
M. herbaceus Bruner*
M. pictus Scudder
M. bowditchi bowditchi Scudder*



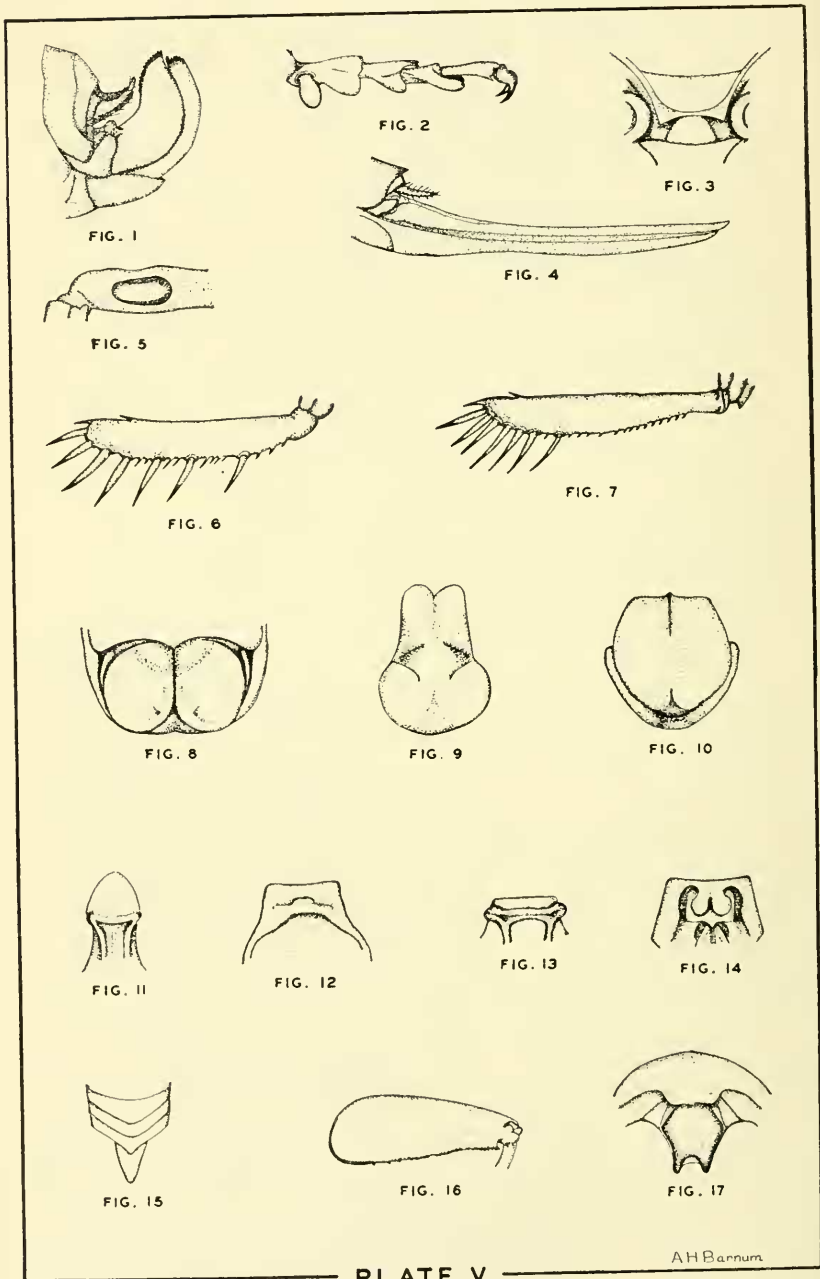
- M. bowditchi canus* Hebard^{AC}
M. flavidus flavidus Scudder*
M. kennicotti kennicotti Scudder^{AC}
M. bruneri Scudder*
M. mexicanus mexicanus (Saussure)
M. mexicanus bilituratus (Walker)
M. devastator Scudder
M. dawsoni (Scudder)^{AC}
M. bohemani (Stal)*
M. saltator Scudder
M. fasciatus (F. Walker)
M. borealis palaceus Fulton^{AC}
M. borealis utahensis Scudder
M. femur-rubrum femur-rubrum (DeGeer)
M. cinereus Scudder
M. complanatus complanatus Scudder^{AC}
M. complanatus canonicus Scudder
M. dodgei (Thomas)
M. angustipennis (Dodge)
M. packardi Scudder
M. foedus foedus Scudder*
M. solitudinis Hebard
M. alpinus Scudder
M. infantilis Scudder
M. confusus Scudder
M. keeleri luridus (Dodge)
M. differentialis nigricans Cockerell
M. bivittatus (Say)
M. yarrowi (Thomas)
7. Body color greenish (8)
 Body color darker (9)
 8. Posterior margin of pronotum angulate; body bright green
 with full-length dorsal white stripe; sides of pronotum
 with black patch Genus *Hesperotettix*
 Posterior margin of pronotum convexly rounded; body uni-
 formly greenish without stripes Genus *Aeoloplus*
 9. Pronotum with distinct lateral keels Genus *Oedaleonotus*
 O. enigma (Scudder)
 O. borckii orientis Hebard^{AC}
 Pronotum without keels (10)
 10. Head excessively large in proportion to pronotum, wider,
 even excluding the eyes, then the pronotum
 *Phoetaliotes nebrascensis* (Thomas)
 Head normal in size Genus *Melanoplus*
 FAMILY TETTIGONIIDAE (Long-horned Grasshoppers, Katydid, etc.)

Many different and distinct forms can be found among the long-horned grasshoppers, but definite morphological characteristics show their relationships to one another. All members of the family have extremely long, finely tapered antennae and four-jointed tarsi, without pads between the claws. The females have a compressed, blade-like ovipositor. The hearing organs are situated on the front tibiae, and the tegmina of the males are modified to form a sounding-board for the stridulating apparatus.

1. Wings present or represented by short pads; front tibiae

- with auditory organs (Pl. V, Fig. 5) (2)
 Wings absent; front tibiae without auditory organs (5)
2. Mostly long-winged green species; first two tarsal segments without lateral grooves; ovipositor broad, flat, curved sharply upward (Pl. V, Fig. 1). (Subfamily Phaneropterinae) (6)
 Mostly short-winged; tegmina as long as wings; ovipositor long, narrow (Pl. V, Fig. 4) (3)
3. Form slender; pronotum normal in size; hind tarsi without plantula. (Subfamily Conocephalinae) (4)
 Form robust; pronotum large, produced over base of abdomen, often concealing rudimentary female tegmina; hind tarsi with free plantula at base of first segment (Pl. V, Fig. 2). (Subfamily Tettigoniinae) (9)
4. Prosternal spines cylindrical, slender; body 18 mm. or longer; ovipositor upcurved *Orchelimum gladiator* Bruner^{AC}
 Prosternal spines very short or wanting; body less than 17 mm.; ovipositor nearly straight; wings usually short. *Conocephalus fasciatus vicinus* (Morse)*
5. Head large; antennal bases widely separated; tarsi with pulvilli. (Subfamily Stenopelmatinae)² *Stenopelmatus fuscus* Haldeman
 Head smaller; antennal bases very close together; tarsi without pulvilli. (Subfamily Rhapidophorinae)² (18)
6. Size small, less than 38 mm.; tegmina narrow, hind margin usually sinuate; pronotum saddle-shaped (7)
 Size large, more than 38 mm.; pronotum not saddle-shaped; pronotum with hind margin broadly rounded (8)
7. Comparatively robust species; tegmina broad, frequently barred with white; hind wings not over 7 mm. longer than tegmina. Genus *Insara*
 I. elegans elegans (Scudder)^H
 I. elegans consuetipes (Scudder)^H
 Extremely slender, long-legged species; wings, if present, uniformly colored and tegmina more than 7 mm. shorter than hind wings. Genus *Arethaea*
 A. coyotero Hebard^H
 A. gracilipes gracilipes (Thomas)*
8. Tegmina long and narrow, but little wider at middle than at apex; fastigium between antennae little wider than first antennal segment *Scudderia furcata furcifera* Scudder
 Tegmina distinctly wider at middle than at apex; fastigium much wider than first antennal segment *Microcentrum rhombifolium* (Saussure)*
9. Wings short, rarely longer than pronotum and often, especially in female, rudimentary or wanting (10)
 Wings fully developed, extending far beyond tip of abdomen in both sexes Genus *Capnobotes*
 C. fuliginosus (Thomas)
 C. occidentalis (Thomas)
10. Prosternum armed with a pair of indistinct, sharply triangular spines (Pl. V, Fig. 3) *Eremopedes ephippiatus ephippiatus* (Scudder)*
 Prosternum unarmed (11)
11. Pronotum without indications of lateral carinae on anterior half or indicated only by color (12)
 Pronotum with persistent lateral carinae (except sometimes on posterior fourth) (15)
12. Hind femora, except in young specimens, less than twice as

2. Recent authors have placed the Stenopelmatinae and Rhapidophorinae into a separate family, the Gryllicrididae.



- long as pronotum *Anabrus simplex* Haldeman
Hind femora more than twice as long as pronotum (13)
13. Tegmina of female not projecting beyond pronotum, of
male rarely projecting one-half the length of pronotum (14)
Tegmina of female projecting somewhat beyond pronotum,
of male projecting one-half or more than one-half the
length of pronotum Genus *Idiostatus*
I. hendersoni Hebard
I. variegata Caudell^{AC}
14. Size large, pronotum 12 mm. or more in length; pronotum
with distinct lateral and median carinae on posterior half;
posterior femora less than two and one-half times as long
as pronotum; ovipositor curved lightly upward
..... *Anabrus simplex* Haldeman
Size smaller, pronotum 8 mm. or less in length; pronotum
without carinae on posterior half; posterior femora more
than two and one-half times as long as pronotum; ovipos-
itor usually more noticeably curved upward
..... *Eremopedes ephippiatus ephippiatus* (Scudder)*
15. Hind femora short, less than twice as long as pronotum;
posterior tibiae with four apical spines below
..... Genus *Plagiostira*
P. albonotata albonotata Scudder
P. gillettei Caudell
Hind femora long, twice or more as long as pronotum (16)
16. Lateral lobes of pronotum declivant, slightly so in *Steiroxys*;
posterior femora three or more times as long as pronotum,
much swollen in basal half (17)
Lateral lobes of pronotum perpendicular, or almost so;
posterior femora little if any more than twice as long as
pronotum Genus *Plagiostira*
17. Tegmina well developed, overlapping above and projecting
about one-half the length of pronotum in both sexes
..... *Clinopleura melanopleura* (Scudder)
Tegmina of female forming slightly projecting lateral pads,
widely separated above Genus *Steiroxys*
S. pallidipalpus (Thomas)
S. trilineatus (Thomas)
18. All tarsi 4-segmented (19)
Front or front and hind tarsi 3-segmented, the two proxi-
mal segments fused (20)
19. Dorsal surface of front tibiae with a stout spur slightly dis-
tad of middle of front margin *Udeopsylla robusta* (Haldeman)
Dorsal surface of front tibiae unarmed except at apex
..... Genus *Ceuthophilus*
C. utahensis Thomas
C. mormonius Hubbell
C. wasatchensis Hubbell
C. unguiculatus Hubbell
C. arizonensis Scudder
C. gertschi Hubbell
C. fusiformis Scudder
C. caudelli Hubbell
C. hebardi Hubbell
C. fossor Hubbell
C. lamellipes Rehn
20. Front tarsi alone 3-segmented *Dahinioides hastiferum* Rehn*
Both front and hind tarsi 3-segmented (21)
21. Dorsal margins of hind tibiae with five relatively short, very
heavy spurs (exclusive of calcars), these rather widely

separated (Pl. V, Fig. 6); large, robust, heavily sclerotized insects *Daihinia brevipes* Haldeman*
Dorsal margins of hind tibiae with seven very long spurs
(exclusive of calcars), closely crowded in distal half of
tibiae (Pl. V, Fig. 7) .. *Ammobaenetes phrixacnemoides* (Caudell)*

FAMILY GRYLLIDAE (Crickets)

The crickets, like the Tettigoniidae, have long, delicately tapering antennae and auditory organs on the front tibiae. The males have stridulatory organs on the tegmina. They differ from the long-horned grasshoppers, however, in having three-jointed tarsi, an awl-like or needle-like ovipositer, and tegmina which are flat above and bent sharply downward at the sides of the body. These insects are essentially nocturnal, but are also active to a considerable extent during the day. Some are among the most numerous and common insects and are widely distributed; others are exceedingly rare and very local in distribution.

1. Hind tibiae armed with rows of long spines (2)
Hind tibiae without rows of long spines, but with rows of short teeth; body covered with scales. (Subfamily Mogoplistinae) *Cycloptilium comprehendens interior* Hebard
2. Form robust; brown or black; head vertical (3)
Form slender; greenish; hind tibiae armed with long, delicate spines with minute teeth between; head horizontal. (Subfamily Oecanthinae) Genus *Oecanthus*
O. niveus (DeGeer)
O. californicus californicus Saussure*
O. californicus pictipennis Hebard
O. nigricornis quadripunctatus Beutemuller*
O. nigricornis argentinus Saussure
3. Wingless; hind femora enormously enlarged; eyes small; of minute size. (Subfamily Myrmecophilinae)
..... *Myrmecophila manni* Schimmer*
Winged at least in the adult male; medium to large size; spines of hind tibiae without small teeth between (4)
4. Hind tibiae armed with fixed long spines; no large bristles on body or legs; medium to large size, 12-22 mm. (Subfamily Gryllinae) (5)
Hind tibiae armed with long, movable spines; many bristles on body and legs; size smaller. (Subfamily Nemobiinae)
..... Genus *Nemobius*
N. fasciatus fasciatus (DeGeer)
N. carolinus neomexicanus Scudder*
N. mormonius Scudder
5. Fore wings of male with three to six transverse veins; large in size; very common; hind tibiae with five to eight spines on each upper margin *Gryllulus assimilis* (Fabricius)*
Fore wings of male with two transverse veins; medium size; hind tibiae with four to six spines on upper margin
..... *Miogryllus lineatus* (Scudder)

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